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AUTHOR	Bourne, Charles P.
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ABSTRACT

The objectives of the study leading to this report were to review, analyze and summarize published library cost data; and to develop a cost model and a methodology for reporting data in a more consistent and useful way. The cost model and reporting procedure were developed and tested on the circulation system of three libraries: a large university library and two large public libraries. The model permits the computation of unit costs for component subsystems of circulation systems. Cost data is summarized and reviewed, and the cost reporting form is included for use by other libraries. A bibliography of 304 references surveyed for cost data is included. (AB)

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FINAL REPORT

Project No. 0-8020
Contract No. OEC-0-70-5235

DATA COLLECTION AND COST MODELING FOR LIBRARY CIRCULATION SYSTEMS

November 4, 1970

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

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Charles Bourne and Associates
Menlo Park, California

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I INTRODUCTION

Relatively little objective and transferable cost data is available in the library field to describe the effort required to perform specified repeatable tasks or to provide specified services. Furthermore, the methodology has not been established in the library field to prepare this data. Most library time and cost figures that have been reported to date have suffered from inadequate rigor of analysis and poor documentation of the supporting information. Consequently, the reported data are often of questionable credibility, and often reported in a way that does not permit its extrapolation to other library situations.

What is needed is (1) the development of a useful methodology of library cost analysis and reporting, and (2) the careful preparation of a collection of normalized times and costs for repeatable library operations, written and documented in a form that would permit their utilization and extrapolation in a wide variety of library situations. The availability of such data, properly derived and documented, would benefit the operators, designers, and administrators of many library systems. In addition, the establishment and reporting of times and costs in a well-designed manner may encourage others to report their data in the same framework.

The small study effort represented by this report concentrated in the area of library circulation systems, and had the following major objectives:

- Review, analyze, and summarize the published library cost data.
- Develop a cost model, and a methodology and reporting procedure to permit others to report their data in a more consistent and useful way.

Both of these objectives were met, and the results are described in subsequent sections of this report.

II COST DATA REPORTED IN THE LITERATURE

A. CHARACTERISTICS OF THE REPORTING

Many articles and reports have been written that make some mention of circulation systems. One of the objectives of this study was to identify and review the literature that reported circulation system costs. The study was not meant to review or compare circulation systems as such. The bibliography in Appendix C includes over 300 publications that have something to say about circulation systems. This bibliography represents the results of an attempt by this project to identify such publications from 1960 to the present. A few older publications--those that had cost data or were particularly relevant--were also included in the bibliography. Many types of systems (e.g., edge-notched cards, photocharging) and many specific installations (e.g., UCLA) were discussed in these publications. An index to the circulation system literature by organization and by circulation system type is included as Appendix B to this report. Unfortunately, only a small fraction of all of this literature presented any useful cost data.

The published cost reports can generally be characterized as incomplete. The authors of these reports have seldom defined the scope of activities included in what they call their circulation system (e.g., they have not specified whether their costs include such things as reshelving, direct supervision, and preparation of overdue notices). Many of the reports have left a variety of cost elements unmentioned in their analyses, including such major items as labor and materials. As a result, many of the cost reports are actually underestimates of the true costs. Some of the cost reports provide only general statements, rather than specific numbers. For example, one author makes the statement, "It is estimated that the cost of operating the new system will be about the same as the present system," without giving the cost of either system.

In several cases it was not possible to determine whether an article was discussing actual library experience, or projections of present or proposed system. The costs reported by the ALA Library Technology Project, based on analytical time and cost estimates, were generally lower than the costs reported by many case studies that were based upon actual operating experimences, and were all lower than the costs of the three case studies done on this project. Because of all of the above differences, it would seem inappropriate and hazardous to make direct system-by-system comparisons from this data, which was reported in such diverse ways.

B. STEPS TAKEN TO NORMALIZE THE PUBLISHED COST DATA

Two major steps were taken in this study to summarize and present the published data in a more uniform manner for further analysis:

(1) Conversion to a unit transaction cost

(2) Conversion to 1968 dollars.

A unit cost per circulation transaction was used in this study to permit the bulk of the cost data to be summarized and compared in a uniform manner. For this study, a circulation transaction was defined to include check-out and check-in operations, and supporting record-keeping associated with a recorded loan. Some authors reported their cost data in terms of such a unit cost. However, for much of the literature it was necessary to derive or compute such a figure from the data given in the report.

Almost all of the reports reported a total system cost. However, a few publications also provided the basis for unit cost data for selected portions of the system such as shelving, or the preparation of bills and recall notices. The following subtasks of the circulation process were given special attention in the literature, and were analyzed in this study to derive and report their unit costs: (1) preparation of borrower cards, (2) preparation of book cards, and (3) preparation of machine-readable bibliographic records. All of these subsystem costs were identified and tabulated for this report.

Because of the continued change over the years in the value of the dollar, some data correction is necessary in order to make the reported cost data more directly comparable. For this reason, all of the reported or derived unit total system costs were converted into equivalent 1968 dollars, based upon the date of the original report. The conversion factors used for this are given in Table 1. Unfortunately, this conversion does not completely correct for the changing dollar value because the date of any particular report is not exactly the same as the date associated with the reported data. However, this correction does remove some of the obstacles to a review and comparison of the reported data.

C. OBSERVATIONS ABOUT THE REPORTED DATA

1. Total System Cost

Unit costs for the total circulation system, as reported in or derived from the literature, were tabulated and summarized for this study for over 20 reporting organizations. These costs were also plotted as a function of annual circulation volume to show how the unit cost is related to the size of the system. Figure 1 shows this unit cost data for various types of libraries, and Fig. 2 shows this data for various types of circulation systems. A summary of the collected data, accompanied by explanatory comments, in given in Table 2.

The reported unit costs for total systems ranged from 0.6 to 74.6 cents per circulation transaction, with most of the costs in the range of 5 to 15 cents per transaction. The size of the circulation system, as measured by annual volume of circulation, did not seem to be a significant

Table 1

FACTORS USED TO CONVERT COST FIGURES TO 1968 DOLLARS

Year	Purchasing Power as Measured by Consumer Prices ($)*	Multiplication Factor Used in This Report to Convert to 1968 Dollars
1940	2.048	2.482
1944	1.632	1.978
1945	1.595	1.933
1946	1.471	1.783
1947	1.285	1.558
1948	1.194	1.447
1949	1.205	1.461
1950	1.194	1.447
1951	1.106	1.341
1952	1.081	1.310
1953	1.072	1.299
1954	1.069	1.296
1955	1.071	1.298
1956	1.056	1.280
1957	1.021	1.238
1958	.994	1.205
1959	.985	1.194
1960	.971	1.177
1961	.960	1.164
1962	.949	1.150
1963	.937	1.136
1964	.925	1.121
1965	.910	1.103
1966	.884	1.071
1967	.860	1.042
1968	.825	1.000

*Source: Department of Labor, Bureau of Labor Statistics. Reprinted in 1969 Statistical Abstract of the United States. U.S. Department of Commerce. Table No. 500. "Purchasing Power of the Dollar: 1940 to 1968." (1957-59 average = $1.00)

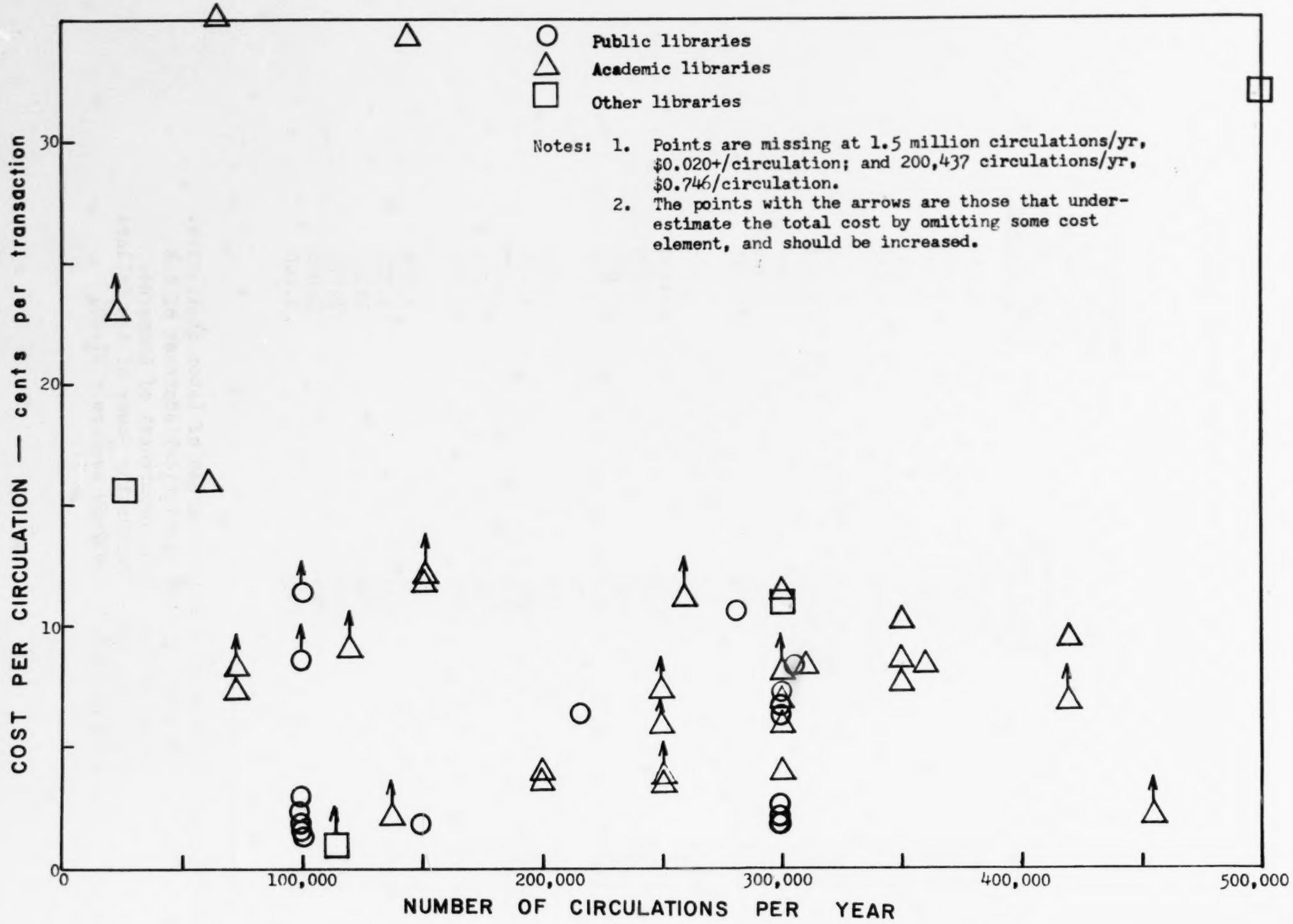

Fig. 1

Total Circulation Systems Unit Costs
Reported in the Literature
(By type of library)

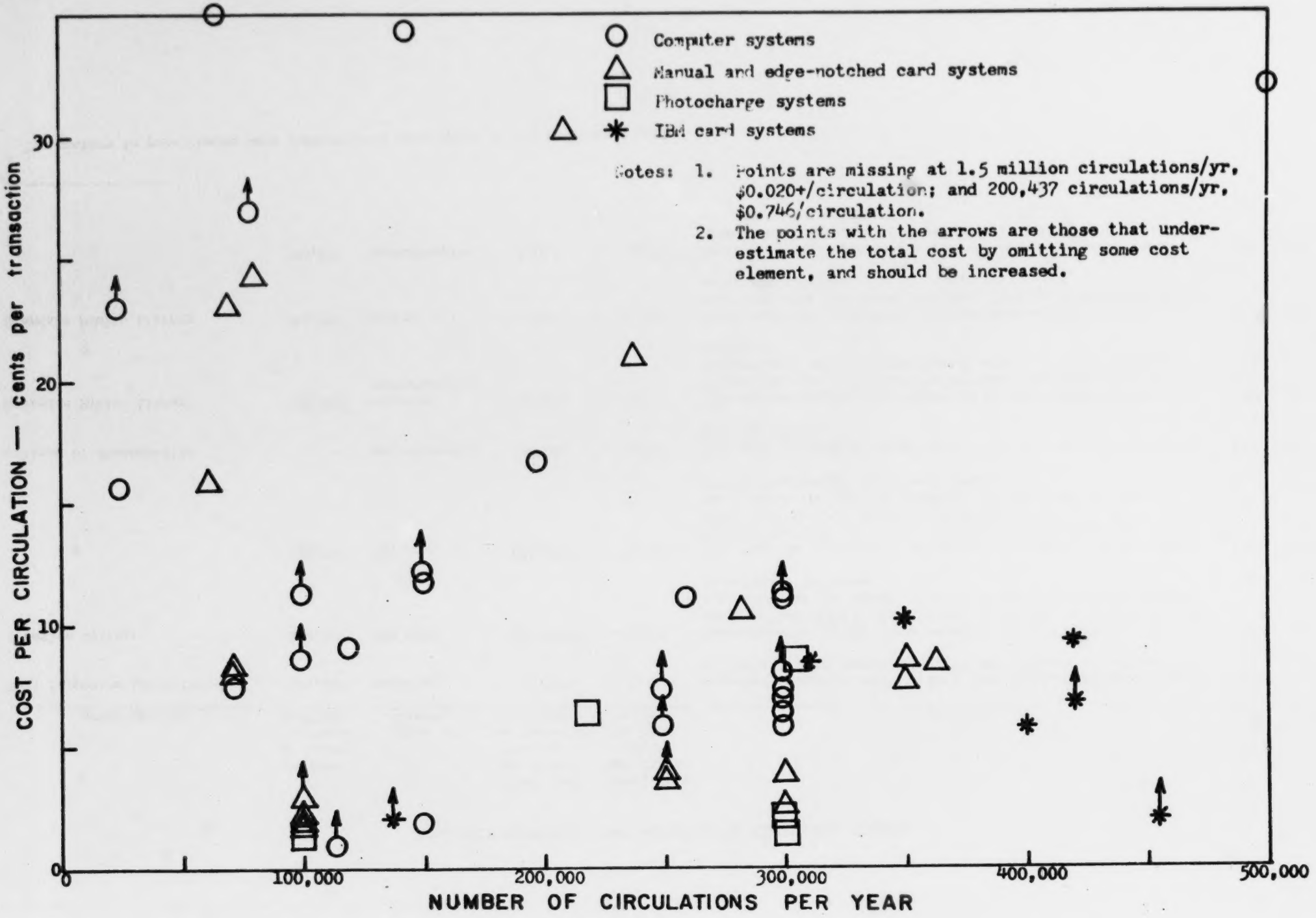

Fig. 2

Total Circulation Systems Unit Costs
Reported in the Literature
(By type of circulation system)

Table 2

TOTAL UNIT PROCESSING COSTS REPORTED FOR CIRCULATION SYSTEMS

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
Bell Telephone Laboratories	300,000	computer	0.110+	0.110+	Reported equipment rental costs were $33,000 per year, resulting in equipment costs of $0.110 per circulation transaction.	1968	174
Brooklyn College	138,757	IBM card	(0.018+)*	0.021+	Non-recurring annual costs reported include machines ($2,400) and supplies ($218), for a total of $2,618, exclusive of other costs such as the labor costs of 18 persons employed in the Circulation Division.	1960	38
	455,000	IBM card	(0.018+)	0.020+	"... the IBM circulation operation is cheaper with machines renting for $220 per month, attended by two part-time clerks with total monthly salaries of roughly $480 ..." This does not include the cost of supplies, or the labor of the rest of the Circulation Department staff.	1964	297
College of Steubenville	--	photocharging	0.006	0.008	"Our cost accounting shows that photocharging costs 0.6 of a cent per charge."	1952	60
Essendon Public Library	150,000	computer, photocharging	(0.016)	0.017	"The annual running cost based on an anticipated circulation of 150,000 were calculated to be about the same, $2,500." (Comparing a photocharging system with a proposed computer system.)	1967	55
Glendale Public Library	282,276	manual	0.078	0.105	Total costs for operating a manual system during the period July 1946-June 1947 were $22,026. This includes labor, equipment, and supplies.	1951	216
	305,264	photocharging	0.063	0.084	Total costs for operating a photocharging system during the period July 1948-June 1949 were $19,339, including labor, equipment, and supplies.	1951	216

* The numbers in parentheses were derived from data given in the referenced publications.

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
Harvard University--Widener Library	310,000	IBM card	0.075	0.083	Including machines, labor, and supplies but excluding fine collection, overdue notices after the first, and shelving and shelf search.	1965	195
IBM Corp., Thomas J. Watson Research Center	26,000	computer	0.141	0.156	Including machines, labor, and supplies, but excluding fine collections, overdue notices after the first, and shelving and shelf search.	1965	195
Illinois State Library	500,000 (est.)	computer	0.320	0.320	"A breakdown of average costs during the past year indicates that the cost per transaction has been 32 cents. When we compare this to manual charge costs, we find it broadly comparable except in the case where a large, cheap labor supply is available." The number of transactions per year was not stated, but is assumed to be on the order of 500,000.	1968	129
Johns Hopkins University, Applied Physics Laboratory	22,000	computer	(0.229+)	0.229+	"The average monthly (computer) cost of running the old system for the 5 months October 1968 through February 1969 was $1,426.82. The average (monthly) cost of the new system for April through June 1969 is $420.43." Using the most recent costs and extrapolating to a full year of operation results in a total computer time cost of $5,045.16 per year, or a unit cost of $0.229 per computer time alone.	1969	41
Lehigh University	151,000	computer	(0.111+)	0.116+	An interpretation of the reported data (to add more computer time) suggests that the costs for a full year of operation would be about $16,763, exclusive of the salaries of the professional library staff.	1967	104,105
	151,000	computer	(0.116+)	0.121+	The budget for 1966-67, excluding salaries and wages, was $17,500. Assuming the same circulation volume, this is a unit cost of $0.116 per circulation transaction, exclusive of salaries and wages.	1967	104,105

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
Linden Public Library	218,000	photocharging	0.058	0.062	The total annual cost for labor, material, equipment, and general costs of a proposed system was $12,569. "There are about 218,000 books circulated annually; $12,569/218,000 yields a cost per volume circulated of $0.058. This cost compares favorably with the published figures of other systems." (p. 252)	1966	98
Michigan State University	209,000	manual	0.290	0.302	"In the 1959-60 school year ... circulation of materials ... was decentralized ... In an early attempt to develop a program budget, we determined that our costs for circulation, exclusive of the students' own time, were 29 cents per transaction." In a private letter, the author stated that this cost was for an annual circulation of 209,000 volumes.	1967	70
	238,500	manual	0.200	0.208	"The initial solution to our problem was to centralize circulation at one point ... Not only did this change make for a more efficient system, but our costs were reduced to 20 cents per transaction." In a private letter, the author stated that this cost was for an annual circulation of 238,500 volumes.	1967	70
National Agricultural Library	200,437	manual	(0.676)	0.746	The function of the Division of Lending is to maintain, circulate, and lend publications. Total loans in FY 1962 were 200,437. The costs of relevant sections of the Lending Division were (p. 417): Loan Section (Circulation Unit, Periodical Routing Unit, and Window Units, $57,734; Maintenance Section (Bookstacks Unit), $77,800. Total, $135,534.	1965	220
Picatinny Arsenal	114,000	computer	(0.007+)	0.008+	Reported monthly costs include material ($7) and equipment ($756), for a total of $763, exclusive of labor.	1964	138

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
Queen's University of Belfast	--	manual	(0.078+)	0.084+	"With the present (manual) system the cost per loan works out at 6.7d, including staff costs for all aspects of circulation control, but excluding stationery and overheads." At the 1966 exchange rate of $2.80 per £, this amounts to a unit cost of $0.078 per circulation transaction.	1966	178
	--	computer	(0.070+)	0.075+	"A cost of 6.0d per loan has been calculated for the computer system, but this figure only includes those items of hardware which will be charged to the library ... and clerical staff time for charging and discharging ... This means in fact, that the total real cost of the system is going to be of the order of 2 or 3 times that of the present system." At the 1966 exchange rate, this amounts to a unit cost of $0.070 per circulation transaction.	1966	178
	72,403	manual	(0.079+)	0.082+	"These calculations show that (manual) circulation work cost the library a total of £2,027 in salaries for the 12 months May 1965 to April 1966. During this period, a total of 72,403 volumes were circulated. This results in a cost per circulation of 6.72 pence." At the 1966 exchange rate of $2.80 per £, this results in a unit labor cost of $0.079 per circulation transaction for the manual system.	1967	180
	72,403	computer	(0.070+)	0.073+	With regard to the computer system, "We have found that staff plus library equipment and data link costs together add up to a total of 6.02 pence per loan ... When computer operating costs, and development and software costs are added, however, it is likely that the automated system will be from 50% to 100% more expensive than the manual system, in total real costs." At the above exchange rates, this is a unit cost of $0.070 per circulation transaction for the on-line system.	1967	180

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
Queen's University of Belfast (continued)	72,403	manual	(0.078+)	0.078+	"... a cost is to be attributed to circulation work for the academic year 1965-66, during which this analysis was made. A total of 72,403 loans were made from the main University library during the year, so that the cost per loan is ... 6.7 pence." This cost was for labor only. At the exchange rate of $2.80 per £, this is a unit cost of $0.078 per loan.	1968	179
	260,000	computer	(0.110+)	0.110+	The projected average cost for an on-line computer system over the period 1971-1975 was 9.4 pence per loan, including computer and labor costs, but not material costs. At the above rate of exchange, this is a unit cost of $0.110 per loan.	1968	179
State University of New York at Buffalo	300,000	computer	(0.075+)	0.080+	Computer equipment costs for a proposed system amount to a total of $22,524 per year. This is a unit cost of $0.075 per circulation transaction for computer equipment alone.	1966	189
Texas A & M University	120,000	computer	(0.084+)	0.090+	"Currently there are about 12,000 charge records in the computer, and probably an average of 800 updates (charges and returns) for each day." It was assumed that the total annual circulation was 120,000 volumes per year. "Our total cost for rental of the data processing equipment located in the library, less various standard educational discounts, is $355 per month. A flat monthly charge of $400 is paid to Data Processing for use of machine time, resulting in a yearly cost of $9,060. The continuous forms for printed listing and the postcard stock plus the other special card forms add another $1,000 per year." This makes a total of $10,060, exclusive of labor costs.	1966	270

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
University of California at Berkeley	400,000	IBM card	(0.050)	0.057	"The UC Library at Berkeley has made use of a semi-automated IBM circulation system for a number of years. They hand-file and hand-discharge their loan records and sort overdues by machine. Total labor costs ... amounts to 7,000 hours annually at $1.85/hr., or nearly $13,000. Card costs of $5,400 and IBM machine rental (3 machines) of $2,500 brings the total cost to more than $20,000. This compares quite favorably with the cost of the manual, semi-automated, and automated systems thus far described." A recent communication from that facility disclosed that, "The volume of circulation in Loan Department, the only department using a semi-automated system, varied between 400,000 and 450,000 charges per year during the last decade."	1963	84
University of California at Los Angeles	350,000	manual	(0.074)	0.084	"The ... (manual) circulation procedures ... for a circulation of 350,000 volumes required around 14,600 hours per year at an average hourly rate of $1.73, or a total expenditure of over $25,000. Additional annual costs of $1,350 for 1.5 million call slips and $333 for 100,000 book checks brought this figure to a total of $26,000."	1963	84
	350,000	IBM card	(0.089)	0.101	Annual costs reported for the IBM card system included: total labor for 11,000 hours at an average of $1.84 per hour ($20,210), $2,500 for 1.7 million IBM cards, and five IBM machines ($8,200), all for a total of $31,000 per year.	1963	84
	350,000	edge-notched cards	0.066	0.075	The report estimated an annual cost of $23,000 (8,000 labor hours at $1.75/hr., plus card costs of $9,000) for a hypothetical Keysort system.	1963	84
	363,061	manual	(0.074)	0.083	Annual cost reported for the prior manual system included 14,612 hours of staff labor at an average cost of $1.73/hr. ($25,325), call slips ($1,350), and book checks ($300), for a total of $26,975.	1964	85

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
University of California at Los Angeles (continued)	420,000	IBM card	(0.084)	0.094	Annual costs reported for the IBM card system included 7,592 hours of machine room staff ($15,149), 10,192 hours of manual staff at $1.64/hr. ($4,264), IBM cards ($2,492), and IBM machine rental ($13,373), for a total of $35,278.	1964	85
	420,000	IBM card	(0.061+)	0.067+	Including machines, labor, and supplies, but excluding fine collections, overdue notices after the first, and shelving and shelf search.	1965	195
University of California at Santa Cruz	145,526	computer	0.343	0.343	"... each completed book charge and discharge cycle costs 34.3¢."	1969	163
University of Hawaii	--	manual	--	--	"The cost of the system that the computer charging replaced was $53,028 per year. These figures are based on actual payroll records for both periods, supplies and rentals shown on the university books, and time billed by the Computer Center ... The net cost of computer charging was found to be substantially more than double that of the old manual charging system ..."	1965	264
	--	computer	--	--	"... the annual cost of the computer charging for salaries, machine rental, and supplies in the library was $86,499 plus cost of computer time of $33,000, or a total of $119,499 per year."	1965	264
University of Kent, Canterbury	69,000	manual	(0.230)	0.230	A total cost of £6,625 was given for FY 1968-69, and included labor and materials costs. At the 1968 rate of exchange (1£ = $2.40), this corresponds to $15,900.	1969	106
	81,700 (est.)	manual	(0.242)	0.242	A total cost of £8,226 was estimated for FY 1970-71, and included labor and materials. At the above rate of exchange, this corresponds to $19,742.	1969	106
	81,700	computer	(0.272+)	0.272+	A total cost of £9,244 was estimated for FY 1970-71, and included labor, materials, and equipment, but excluded computer costs. At the above rate of exchange, this corresponds to $22,185.	1969	106

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
University of Michigan	200,000		(0.035-0.040)	0.035-0.040	A test circulation file of 600 charge records was used to obtain processing times and costs. The following costs were reported for a system with 15,000 charges per year:	1968	99

System	Total Cost ($)	Unit Cost ($)
Brooklyn	525.40	(0.035)
Two-file	606.40	(0.040)
Tabbed-Book Card	593.40	(0.039)

University of Southampton	61,181	manual	(0.159)	0.159	This is the actual cost of operating a manual system in 1965-66, its last year of operation, and includes labor, equipment, and supplies. The total cost was £3,481, which at the 1965 exchange rate of $2.80 per £, was equivalent to $9,747.	1970	215
	65,728	computer	(0.358)	0.358	"The average cost per issue in 1968-69 ... was £0.1278." This includes the costs of labor, data preparation, and computer runs. At the above exchange rate, this is equivalent to $0.358 per issue. These costs were based on the actual costs of running the system in 1968-69.	1970	215
Ventura County and City Library	1,500,000	IBM card	(0.020+)	0.020+	"Ventura County and City Library presently has a book collection of 350,000 volumes, 50,000 borrowers, and operates from 15 branches and 5 bookmobiles. Current circulation is about 1½ million books a year and growing rapidly ..." The total cost for the system in operation in 1967-68 was reported as $30,465, however this did not include all of the circulation costs.	1968	18,291
Washington University	198,998	computer	(0.166+)	0.166+	Annual costs are given for staff ($9,865), equipment ($5,962), supplies ($2,175), and computer time ($15,000), for a total cost of $33,002. The staff costs exclude time spent on circulation routines (charging, discharging). "Adjusting for salary and wage differentials between 1965 and today, the staff, equipment, and supplies applicable to the old system amounted to a little less than $34,000 a year."	1968	142

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
Washington University (continued)					The date and circulation volume were not given in the original publication. However, data from the Circulation Department of this school indicate that this was for the period July 1, 1967-June 30, 1968, during which there were 198,998 loans by automation to the borrowers. Charges on the automated system to binding, reserve, study carrels, etc. are not included in that figure. In addition to the loan records, the automated system prepared 64,765 notices for overdue books, fines, recalls, etc.		
not given	--	manual	0.018	0.045	"The average time required for the making and clearing of an individual charge of a book (including all incidental work mentioned) is 2.1 minutes and the average cost is 1.8 cents."	1941	28
not given	100,000	manual	(0.016)	0.019	Newark staff charge numerical system costs, including labor (at $1.50/hr.), equipment, and materials estimated for a public library with 100,000 circulations per year.	1961	115
not given	--	manual	0.034+	0.038+	Labor costs for plain charge card system with double charge card file (from 1961 LTP report).	1965	195
not given	100,000	manual	(0.013)	0.015	Newark self-charge--signature system costs, including labor (at $1.50/hr.), equipment, and materials estimated for a public library with 100,000 circulations/yr.	1961	115
not given	100,000	manual	0.011	0.013	Self Charge transaction system costs, including labor (at $1.50/hr.), equipment, and materials estimated for a public library with 100,000 circulations/yr.	1961	115
not given	--	manual	0.047+	0.052	Newark self-charge signature system with double charge card and borrower circulation files (from 1961 report).	1965	195
not given	100,000	manual	0.021+	0.022+	Newark system labor (at $2.00/hr.), machine, and materials costs estimated for a public library with 100,000 circulation/yr. Costs of fine collection, preparation of overdue notices after the first, and shelving and shelf search are excluded.	1967	197

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
not given	250,000	manual	0.034+	0.035+	Newark system labor (at $2.00/hr.), machine, and materials costs estimated for an academic library with 250,000 circulations/yr. Costs are excluded for fine collection, preparation of overdue notices after the first, shelving and shelf search, registration of borrowers, and furnishing of ID badges.	1967	197
not given	--	photocharging	0.007	0.011	"Properly applied, photocharging can reduce the cost (of charging books) to less than 3/4 of one cent for labor, equipment, and supplies ..."	1947	15
not given	100,000	photocharging	(0.013)	0.015	Recordak photocharging system costs, including labor (at $1.50/hr.), equipment, and materials estimated for a public library with 100,000 circulations/yr.	1961	115
not given	100,000	photocharging	(0.014)	0.016	Regiscope photocharging system costs, including labor (at $1.50/hr.), equipment, and materials estimated for a public library with 100,000 circulations/yr.	1961	115
not given	300,000	photocharging	(0.017)	0.017	Regiscope photocharging system labor, machine, and materials cost for a public library with 300,000 circulations/yr.	1970	198
not given	300,000	photocharging	(0.019)	0.019	Regiscope photocharging system labor, machine, and materials cost for an academic library with 300,000 circulations/yr.	1970	198
not given	100,000	manual	0.028+	0.029+	Demco system labor (at $2.00/hr.), and supply costs as estimated for a public library with 100,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, and shelving and shelf search are excluded.	1967	197
not given	250,000	manual	0.036+	0.038+	Demco system labor (at $2.00/hr.), equipment, and supply costs, as estimated for an academic library with 250,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, shelving and shelf search, registration of borrowers, and furnishing of ID badges are excluded.	1967	197

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
not given	100,000	computer	0.082+	0.085+	IBM 357 system (one card) labor (at $2.00/hr.), supplies, equipment, and computer time costs, as estimated for a public library with 100,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, and shelving and shelf search are excluded.	1967	197
not given	300,000	computer	(0.062)	0.062	IBM 357 (one card) system labor, machine, and materials costs for a public library with 300,000 circulations/yr.	1970	199
not given	250,000	computer	0.056+	0.058+	IBM 357 system (one card) labor (at $2.00/hr.), supplies, equipment, and computer time costs as estimated for an academic library with 250,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, shelving and shelf search, registration of borrowers, and furnishing of ID badges are excluded.	1967	197
not given	300,000	computer	(0.058)	0.058	IBM 357 (one card) system labor, machine, and materials costs for an academic library with 300,000 circulations/yr.	1970	199
not given	100,000	computer	0.108+	0.112+	IBM 357 system (two card) labor (at $2.00/hr.), supplies, equipment, and computer time costs as estimated for a public library with 100,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, and shelving and shelf search are excluded.	1967	197
not given	300,000	computer	(0.065)	0.065	IBM 357 system (two card) labor, machine, and materials costs for a public library with 300,000 circulations/yr.	1970	199
not given	250,000	computer	0.069+	0.072+	IBM 357 system (two card) labor (at $2.00/hr.), supplies, equipment, and computer time costs, as estimated for an academic library with 250,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, shelving, and shelf search, registration of borrowers, and furnishing of ID badges are excluded.	1967	197

Table 2 (continued)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
not given	300,000	computer	(0.062)	0.062	IBM 357 system (two card) labor, machine, and materials costs for an academic library with 300,000 circulations/yr.	1970	199
not given	300,000	manual	(0.025)	0.025	Gaylord system labor, machine, and materials costs for a public library with 300,000 circulations/yr.	1970	199
not given	100,000	manual	0.022+	0.023+	Gaylord system labor (at $2.00/hr.) and materials costs estimated for a public library with 100,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, and shelving and shelf search are excluded.	1967	197
not given	300,000	manual	(0.039)	0.039	Gaylord system labor, machine, and materials costs for an academic library with 300,000 circulations/yr.	1970	199
not given	250,000	manual	0.034+	0.035+	Gaylord system labor (at $2.00/hr.), machine, and materials costs estimated for an academic library with 250,000 circulations/yr. Costs of fine collection, preparation of overdue notices after the first, shelving and shelf search, registration of borrowers, and furnishing of ID badges are excluded.	1967	197
not given	300,000	photocharging/ computer	(0.023)	0.023	Starfile-MICR system labor, machine, and material costs for a public library with 300,000 circulations/yr.	1970	198
not given	300,000	photocharging/ computer	(0.025)	0.025	Starfile-MICR system labor, machine, and material costs for an academic library with 300,000 circulations/yr.	1970	198
not given	300,000	photocharging/ IBM card	(0.020)	0.020	Starfile-IBM punched card system labor, machine, and material costs for a public library with 300,000 circulations/yr.	1970	198
not given	300,000	photocharging/ IBM card	(0.021)	0.021	Starfile-IBM punched card system labor, machine, and material costs for an academic library with 300,000 circulations/yr.	1970	198

Table 2 (concluded)

Organization	Number of Circulations per Year	Type of System	Total Cost per Circulation, as Reported (dollars)	Total Cost per Circulation, in 1968 Dollars	Comments	Date of Report	Reference
not given	300,000	computer	(0.073)	0.073	Standard Register Source Record Punch system labor (at $2.25/hr.), machine, and materials costs estimated for a public library with 300,000 circulations/yr.	1970	199
not given	300,000	computer	(0.069)	0.069	Standard Register Source Record Punch system labor (at $2.25/hr.), machine, and material costs estimated for an academic library with 300,000 circulations/yr.	1970	199

factor with regard to the unit costs, at least as indicated by the plots of Figs. 1 and 2.

There was no clear pattern in Fig. 1 regarding the unit cost as a function of the type of library (public, academic, or other). With regard to the type of system, the data in Fig. 2 seems to support the viewpoint that computer systems are generally more expensive, and that the manual and photocharging systems are the least expensive.

2. Subsystem Costs

The reported costs of preparing machine-readable bibliographic records for circulation (with all authors reporting costs of less than 7 cents per record) are summarized in Table 3. The reported costs of preparing borrower cards are also summarized in Table 3, and are generally higher for those systems that utilize plastic machine-readable cards. The costs for the preparation of book cards are also given in Table 3.

Costs have generally not been reported separately for parts of the circulation system such as the shelving process or the preparation of recall notices or bills. However, a few of these subsystem costs have been identified from the literature, and are summarized in Table 4.

Table 3

UNIT PROCESSING COSTS REPORTED FOR PREPARATION OF BORROWER AND BOOK RECORDS FOR CIRCULATION SYSTEMS

Organization	Preparation of Borrower Cards ($/record)	Preparation of Machine Bibliographic Records ($/record)	Preparation of Book Cards ($/record)	Comments	Date of Report	Reference
California State College at Los Angeles	--	0.056	--	Estimate of direct costs for conversion of basic shelf list data by optical scanning.	1969	63
Johns Hopkins University	--	(0.061)*	--	"The total cost of the entire conversion operation, comprising about 300,000 cards, has aggregated $18,170, substantially less than the original estimate ... the total cost for the entire data conversion of all records, including the microfilming, payments to CDC for their conversion processes, all wages, the purchase of magnetic tapes for the storage of the final product, a generous allowance for wages and computer time for the final editing and reformatting processes, plus an allowance for overhead to the university, is $18,170."	1965	166,167
	--	(0.061)	--	"The total cost for conversion of all records including the microfilming, payments to CDC for their conversion processes, clerical wages, the purchase of magnetic tapes for the storage of the final product, an allowance for wages and computer time for the editing and reformatting processes, plus an allowance for overhead to the university, amounts to $18,170. On a per character basis, this is at a rate of $0.0038 per word of 5 characters, ..." The number of records, or the number of characters per record were not given. Information regarding call number, main entry, title, pagination, size, and number of copies was transcribed. If an 80-character book card is assumed, this amounts to a unit record cost of $0.0608.	1966	80,81
Lehigh University	(0.454+)	--	--	The preparation of laminated and punched ID cards cost a total of $2,272 during the first year of operation. This total included some capital equipment, but was exclusive of labor costs. This was done for an unspecified number (assumed 5000) of cards. The library serves 3000 undergraduates, 1500 graduate students, and 275 full-time faculty members. The supplies list included 6200 cards. This results in a unit cost of at least $0.454 per borrower card.	1967	104,105

* The numbers in parentheses were derived from data given in the referenced publications.

Table 3 (continued)

Organization	Preparation of Borrower Cards ($/record)	Preparation of Machine Bibliographic Records ($/record)	Preparation of Book Cards ($/record)	Comments	Date of Report	Reference
Michigan State University	--	0.059	--	"The cost of converting the first 100,000 volumes was $0.059 per volume ..."	1966	208
	--	0.039 0.046 0.058	0.039 0.046 0.058	"At this point in time, it appears safe to say there is no appreciable difference between keypunching, using paper-tape typewriter or having the shelf list scanned (OCR) by a commercial service bureau. The costs of each of these are as follows: keypunching .0392 cents; paper tape .0464 cents; and service bureau .0575 cents. In the case of keypunching, costs are on the basis of producing two cards; paper-tape includes cost of producing tape and converting it to cards ... and the service bureau figures are for typing, scanning, and production of a magnetic tape. All records are placed on the master book tape and a book card (35 spaces for call number, 12 characters of author, 26 characters of title, and 4 spaces for publishing date) is produced by the computer." It is assumed that the published decimal figures refer to dollars per title, instead of cents as stated.	1967	70
Midwestern University	0.150	—	--	"It (printed paper ID badge laminated and punched for machine reading) gives the patron's surname, Social Security number, and signature, costs about 15¢ to produce and can be used for a complete school year."	1969	49,50
San Fernando Valley State College	--	0.065	--	Estimate from costs experienced for conversion of basic shelf list data by keypunching.		63
Texas A & M University	--	0.039	0.039	"Roughly, the total conversion cost was approximately 3.9¢ per book, and the project, start to finish, took 5 months." This was for 200,000 volumes, and included the cost of gluing in the book pockets.	1966	269
University of Maryland	--	0.060	0.060	A single-page exhibit in an appendix to this Conference proceedings gives the unit costs for each of the steps in the preparation of a machine bibliographic record and circulation book card, and gives a total cost per book card of 6 cents.	1966	214
				"Supplies, optical scanner and computer time, and student help have been estimated at a cost of $8,500 for the conversion--staff time was not included in the estimate."	1965	83

Table 3 (concluded)

Organization	Preparation of Borrower Cards ($/record)	Preparation of Machine Bibliographic Records ($/record)	Preparation of Book Cards ($/record)	Comments	Date of Report	Reference
University of Victoria	0.448		0.160	"The student's badge (borrower card) is printed from the computerized Registrar's File and shows the name, faculty, year, and registration number. The student's signature and picture are obtained at registration time to complete the card. It is then laminated, cut to size, punched with the coded registration number, and returned to the student for use as a Library Card and student identification." The labor, materials, and machine costs for 5000 student cards resulted in a total unit cost of $0.448, excluding the cost of camera, badge cutter, and picture cutter. The conversion costs for 208,000 titles was $0.16 per title, including labor, equipment, and materials costs.	1969	66

Table 4

PROCESSING COSTS REPORTED FOR SELECTED PORTIONS OF THE CIRCULATION PROCESS

Organization	Type of System	Number of Circulations Per Year	Unit Costs ($)			Comments	Date of Report	Reference
			Shelving	Preparation of Bills and Recall Notices	Preparation of Reports			
District of Columbia Public Library	manual	250,000 (est.)	--	(0.045 per notice)* (0.053 per bill - 2nd notice)	--		1962	279
	photocharging	250,000 (est.)	--	(0.026 per notice) (0.026 per bill - 2nd notice)	--			
Indianapolis Public Library		150,000 (est.)	--	(2.129 per delinquent item) (3.919 per delinquent borrower) (0.041 per item circulated)	--	"It was found that, of the total circulation (8,513) during the 3 weeks in operation, 162 items were delinquent ... or 1.9 percent ... we have the sum of $344.93 expended in the effort to recover materials valued at $382.51." This includes material, postage, and labor for sending first and final notices to 88 patrons.	1962	265
University of Michigan		200,000	0.220	(0.180 per notice)	--	With labor charged at $1.19/hr., the cost per renewal was reported to be $0.0214. "Approximate cost of processing these (overdue) notices was $515, or about $0.18 per notice."	1968	61
						"An analysis of the existing system determined the average reshelving delay to be 3 to 4 days and the average reshelving cost to be 22¢."		
Decatur Public Library	manual, IBM card	499,008	--	--	(0.015)	"Previously, circulation statistics required 264 hours each month to compile, at a cost of $7,448 a year."	1961	148

* The numbers in parentheses were derived from data given in the referenced publications.

III GENERAL COST MODEL AND REPORTING FORM

For this study, a cost model was considered to be a representation of the component costs of a circulation system, a representation that identified the components and allowed specific values to be substituted in to permit the computation of various unit costs. For ease of use, the model of this report is cast in a narrative (tabular) form, rather than in a generalized algebraic form. The narrative form of the model is the reporting form included as Appendix A to this report. This model is intended to be general enough to be used for any type of library circulation system, but is also specific enough to permit the identification and inclusion of any relevant cost element. This model tried to get the analyst to identify and assign all those costs that are clearly identifiable with the circulation process. This includes such things as direct labor, materials, and equipment.

A. SUBSYSTEM DEFINITION AND SCOPE

The model includes the following circulation system processes, each of which is illustrated in Fig. 3:

(1) Stack Picking. This is the activity associated with the extraction of books or other items from the stacks by the library staff, and their delivery to a checkout station. Some libraries, particularly those facilities with an open-stack policy, will not have any significant cost associated with this activity. However, this may be a significant part of the system cost for a large closed-stack system. This may also be a major cost element for central libraries that must pick many books from the shelves to satisfy loan requests from their branch libraries.

(2) Check-out Transaction. This is the process, usually performed at the circulation desk, of checking the item out to the user. There may be several check-out or check-in stations in a given library facility.

(3) Check-in Transaction. This is the process, usually performed at the circulation desk, of receiving the book back from the user, and preparing the necessary discharge records. Overdue checking and fine collection may be done as part of this process. In many instances it will be difficult to separate the check-in and check-out costs, because both types of work may be mixed at the same work station. However, it is included in the model for those that can make the distinction.

(4) File Maintenance. This is the effort associated with the sorting and file-manipulation work related to the loan records,

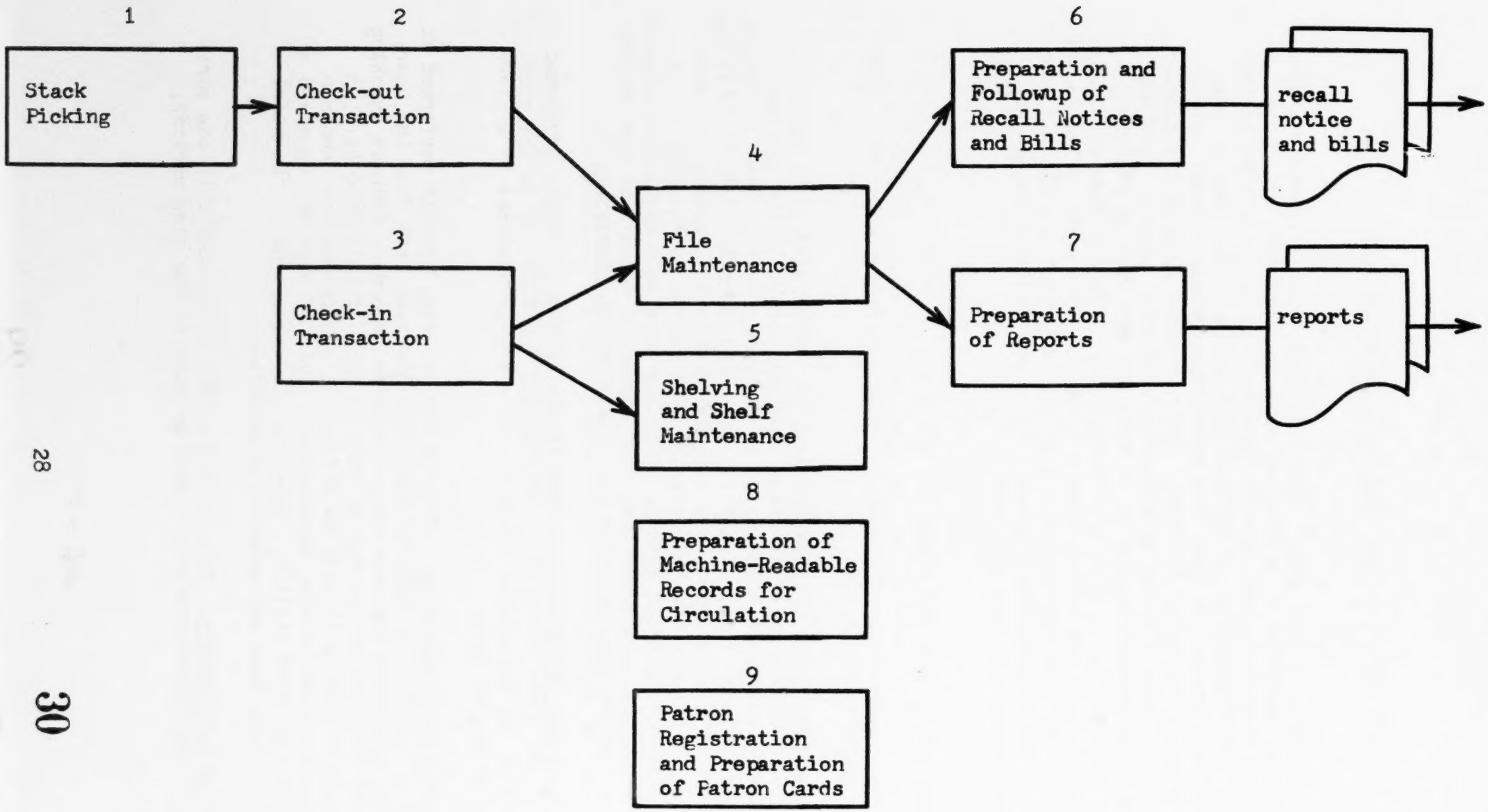

Fig. 3

Major Processes Associated with Circulation Systems

aside from the work directly associated with other named tasks such as the preparation of recall notices and bills, or other reports. For a photocharging system this would include such things as the film processing. For many transaction card or edge-notched card systems, this would include sorting to identify the overdue items (but not preparation of the overdue notices and doing the overdue followup).

(5) Shelving and Shelf Maintenance. All effort associated with maintaining the physical collection in such a way that it can support the circulation system is included in this subtask. This also includes taking the returned items and placing them back into their proper place in the stacks. This also includes the effort to re-shelve the items that are used in-house without being checked out. This also includes the shelf-reading effort to check that the shelf items are in proper sequence on the shelves, and may also include periodic inventory efforts or the shifting of the collection's items from one location to another.

(6) Preparation and Followup of Recall Notices and Bills. This is the effort directly associated with the preparation and delivery of overdue or recall notices and bills. This also includes any followup efforts such as a messenger pickup of the overdue items from the patrons.

(7) Preparation of Reports. The circulation records provide a data base that can be used for reporting of much useful information. This can range from the simplest data such as the monthly totals of adult and juvenile material loaned, to more extensive reports such as periodic tabulations of circulation statistics for each student or class on campus. This effort includes all activities directly associated with the preparation of such reports.

(8) Preparation of Replacement Machine-Readable Records for the Circulation System. Most of the computer circulation systems require a machine-readable record (e.g., IBM book card) to describe the individual item being loaned. In addition to an initial file-conversion effort to prepare these book cards for the system, these records must also be prepared on a continuing basis as new materials are entered into the system. The initial file-conversion cost will be considered a one-time development cost, and excluded as one of the cost factors in this model. The continuing cost to prepare records for new items in the collection will be considered a technical processing cost and will not be included as one of the operating costs of the system. However, the cost to replace a lost or damaged machine record will be considered a regular operating cost, and will be included in the cost model.

(9) Patron Registration and Preparation of Patron Cards. This process includes the work associated with the registration of

patrons, the preparation and replacement of their patron cards, and the preparation and maintenance of the patron registration records.

(10) Other Costs. There are some costs that are definitely associated with the circulation system, but that cannot be easily assigned to a specific subsystem. Provision is made here to identify and include these kinds of costs. An example of such a cost is the labor cost of direct supervision of the circulation system, where the supervisor oversees all aspects of the system.

The model (reporting form) was designed to aid the collection of data consisting of the descriptions and costs of particular circulation systems. The model calls for the reporting to be done in a way that permits the identification or determination of cost factors associated with each of the above subsystem costs, as well as the total system cost. As mentioned earlier, the general subsystems of a circulation system have been defined in this study as those major components listed above and numbered in the flow chart of Fig. 3.

B. GENERAL INSTRUCTIONS

The reporting form calls for sufficient detail to permit subsequent analysis and modification of the original data at some later date or in some different way if desired. For example, in making a comparative analysis of the cost reports of several libraries, an analyst might want to convert all of the clerk salaries to the same pay rate, or charge the same hourly rates for the same type of computer equipment used at different facilities. An individual library, using this form for its own self-analysis over a several-year period, may wish to do some normalizations of this type to aid in its year-by-year comparison of its own cost performance.

The reporting form, used in conjunction with the definitions and instructions given in this report, was intended to be self-administered by interested libraries. In some ways it was planned to be analogous to an Internal Revenue 1040 Tax Reporting Form, in that it establishes a standard and uniform way of reporting the source data for all parties, and leads to computed cost figures that would supposedly be the same, regardless of which analyst filled out the form for a given organization. The reporting form identifies and suggests specific cost components, and leads the analyst through the steps and computations necessary to arrive at the partial and final answers.

This reporting form uses unit costs per checkout transaction as its major unit of measure. A checkout transaction is defined for this study and report to include the removal and return of one book (or other item) from its appropriate shelf location, in those instances in which a record of the movement is to be made, as well as all of the supporting effort

such as recall and billing efforts, and the preparation of reports. This is very similar to the definition used in the ALA Library Technology Project studies of circulation systems: "A unit of circulation is the removal and return of one book from its appropriate shelf location, for which movement a record has been made."

When using the reporting form, unit costs should be reported to the nearest tenth of a cent per transaction. This does not imply a tenth of a cent accuracy, but merely requires that the reporting be consistent in terms of the number of significant digits used in the data.

The circulation transaction count is to include renewals, as well as the check-out of any type of material (e.g., books, maps, serials, audio-visual materials), including material checked out to branch libraries.

It would be helpful if the time span for the data entered by a library in this reporting form were to be for the most recent year of operation. However, shorter or older periods are acceptable. It may even be necessary to use different time periods or volumes of test data for reporting each of the parts of the circulation system, and this is both acceptable and provided for in the reporting form.

Training costs related to the circulation system may be a factor in some libraries, and should be included where possible.

Purchased equipment, unless there are good reasons for doing otherwise, is to be considered as having a useful life of 60 months, and the cost of the equipment is to be distributed uniformly over those 60 months. Equipment maintenance and repair costs should also be included.

The cost analysis techniques developed and described in this report provide a means to determine the operating costs of a circulation system. This should not be confused with cost figures frequently published as "cost per circulation," but which are actually ratios of the total library budget to the total volume of circulation. Such cost figures are actually total library expenses per item circulated, rather than the costs associated with the completion of a loan transaction and all of its record-keeping.

C. SPECIFIC EXCLUSIONS

The model specifically <u>excludes</u> from the analysis items such as the following:

- General supervision and management (but includes direct supervision)
- Planning, research, systems development, and programming
- General office equipment and supplies (including punched card files, and magnetic tapes and disks)

- Overhead costs for lights, heating, and building janitorial and groundskeeping services, etc.

- Employee benefits and other indirect labor costs (e.g., F.I.C.A., state unemployment insurance, group insurance, vacation, holiday, sick leave, retirement plans)

- Assignment and management of carrel study spaces in the stacks (as often done by Circulation Departments in academic libraries)

- Facilities or space costs (e.g., the library buildings or the bookmobiles).

D. LIMITATIONS AND RECOMMENDATIONS FOR USE

This model (reporting form) represents a significant advancement and contribution to the analysis of library operations. However, it must be considered as a preliminary version that needs further testing and modification before it can be recommended for widespread use. The earlier models on this project went through a period of trial use with several libraries, and developed through use into their present form as given in this report. The present model should be used with several more case studies to provide further testing, smoothing, and generalization before it is seriously proposed as a reporting form for universal use. However, even with the form in its preliminary state of development, libraries are encouraged to try to use it on their own circulation systems, so that they can benefit by making some comparisons with the case study data given in this report. It would, of course, be very helpful to the library community if data from several more libraries could be assembled and reported together, using this model, because this new data would probably be much more uniform and meaningful than most of the cost data published to date.

As one final comment, it should be noted that even though the reporting procedures given in this report provide a great improvement toward achieving more uniform cost reporting, their use will still not permit direct system comparisons without some qualifying comments or footnotes. These reporting procedures have removed many of the major obstacles to uniform reporting and comparison; however, there are still many minor factors that should be considered in the reporting and comparison of systems at different facilities. For example, sharper definitions are needed to identify the boundaries between the circulation system and the following library processes:

- Reader services (e.g., where to draw the line between these two functions when a reference librarian suggests a particular book, or helps a patron find a particular book in the stacks).

- Technical processing (e.g., where to draw the line when the preparation of a new book for the collection requires the preparation

of an IBM book card for the use of the circulation system; and whether the effort to shelve a new acquisition should be charged to the circulation system).

Consideration should also be given to the question of the extent to which the reported costs would be influenced by such things as the following:

- The total number of hours a library is open and available for circulation service
- The total number of checkout stations
- The unit cost of a single library versus the unit cost of a combined system of a main library and several branches
- The material being loaned (e.g., movies, art prints, or audio-visual materials may require more extensive checkout and record-keeping procedures than other materials, and hence have an inherently higher unit cost).

Further clarification of these and other problem areas can be developed as the model is used with other case studies.

IV THREE CASE STUDIES USING THE COST MODEL

The cost model developed during this study was tested by using it, in several versions, in case studies of three representative libraries. This trial use and revision helped to make it a more general form, one that would be useful for many types of libraries. It also furnished practical guidance regarding the spacing and layout of the form.

The libraries that cooperated as case studies were:

- University Library. The main loan department of a major university, using a manual system, and with a circulation volume of over 269,000 loans per year.

- Public Library. The main library of a metropolitan system that also includes several branch libraries. The main library has a manual system, and over 512,000 loans per year.

- Public Library System. The library system of a metropolitan area, including a main library, a branch, and two bookmobiles. A computer system is used, with a system total of almost 747,000 loans per year.

In each of the case studies, members of the library staffs worked cooperatively with the author to assemble and report the relevant data, as well as to critique the model and reporting procedures. Their cooperation contributed greatly to the achievements of this project. The cost studies themselves required a relatively small amount of time to complete; typically, one to two man-weeks of effort was sufficient to assemble the data and complete the reporting form for a given library.

The data collected from each of these three libraries is summarized in Table 5, and shows a total system unit cost that ranged from 24.5 to 63.2 cents per circulation transaction. All of these costs determined by the case studies were higher than most of the costs reported in the literature. This is believed to be due to the fact that the case studies represent more complete and comprehensive data reporting than has been the case in the literature. Furthermore, the model includes a broader definition of circulation systems (hence, more contributing cost elements) than is associated with most of the previously published figures.

Aside from noting that the case studies had generally higher total system costs than reported in the literature, no other major comparisons can be made from the case study data because of the small number of facilities represented here. However, the case studies do demonstrate the type of detailed cost information that can be developed and reported for the various parts of the circulation system.

Table 5

UNIT PROCESSING COSTS FOR MAJOR PARTS OF THE CIRCULATION PROCESS
AS DETERMINED IN THE THREE CASE STUDIES
(Dollars per Circulation Transaction)

Organization	Total Number of Circulation Transactions per Year	Type of System	Stack Picking	Checkout Transaction	Check-in Transaction	File Maintenance	Shelving	Preparation and Followup of Recall Notices and Bills	Preparation of Special Reports	Preparation of Machine-Readable Records for Circulation	Patron Registration and Preparation of Patron Cards	Other	Total Unit Cost
University Library	269,247	manual, tab card	--	0.137 (21.68)*	0.071 (11.23)	0.077 (12.18)	0.123 (19.47)	0.096 (15.19)	--	--	0.003 (0.47)	0.125 (19.78)	0.632
Public Library (Main Branch)	512,660	manual	0.117 (36.21)	0.031 (9.59)	0.048 (14.87)	0.026 (8.05)	0.028 (8.68)	0.023 (7.12)	0.004 (1.24)	--	0.025 (7.74)	0.021 (6.50)	0.323
Public Library System (Central Library, 1 branch, and 2 bookmobiles) --Aug. 1970	746,916	computer	0.006 (2.31)	0.062 (23.84)	0.045 (17.31)	0.012 (4.62)	0.027 (10.38)	0.011 (4.23)	0.003 (1.15)	0.006 (2.31)	0.011 (4.23)	0.077 (29.62)	0.260
Public Library System (Central Library, 1 branch, and 2 bookmobiles) --Oct. 1970	746,916	computer	0.006 (2.45)	0.057 (23.27)	0.042 (17.14)	0.010 (4.08)	0.026 (10.62)	0.010 (4.08)	0.003 (1.22)	0.006 (2.45)	0.011 (4.49)	0.074 (30.20)	0.245

* Figures in parentheses represent percent of total unit cost.

An analysis of the major cost elements for these case studies reveals a considerable difference in the amount and proportion of effort spent by each library on its various subsystems. As examples of unique or special costs, the public library reviewed in this study (the main library of a library system) incurs a considerable labor cost in picking items from its shelves to fulfill loan requests from its branch libraries, and the university library reviewed in this study spends many man-hours reshelving items that are left on the tables by the hundreds of students that study daily in the stack areas. However, there were some similarities in the component costs. For example, the total of the check-out and check-in costs ranged from 7.9 to 20.8 cents (24.5 to 41.1 percent of total unit cost) per circulation transaction for the three case studies. This check-out and check-in total may be comparable to the scope and cost considered in most of the published reports. That is, it may be that most of the cost reports in the literature have closely restricted themselves to the check-out and check-in functions, and have not included all of the other real parts and costs of the circulation system that are identified in the model of this report.

An indication of the total system unit costs for these case studies as a function of system volume is given in Fig. 4. A summary representation of the amount and relative percentage of each of the subsystem costs for these case studies is given in Figs. 5 and 6.

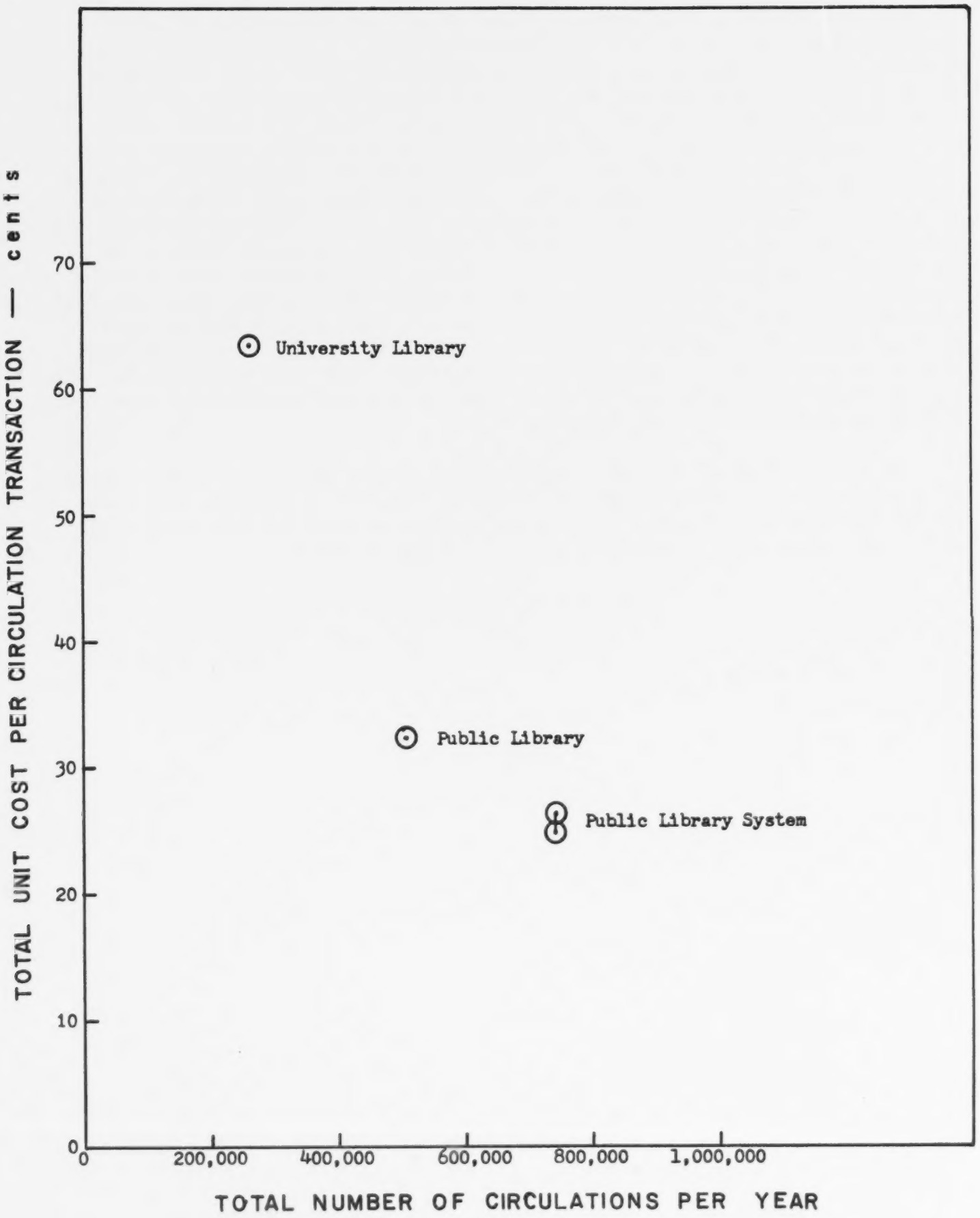

Fig. 4

Total Circulation Systems Unit Costs
Determined in the Three Case Studies

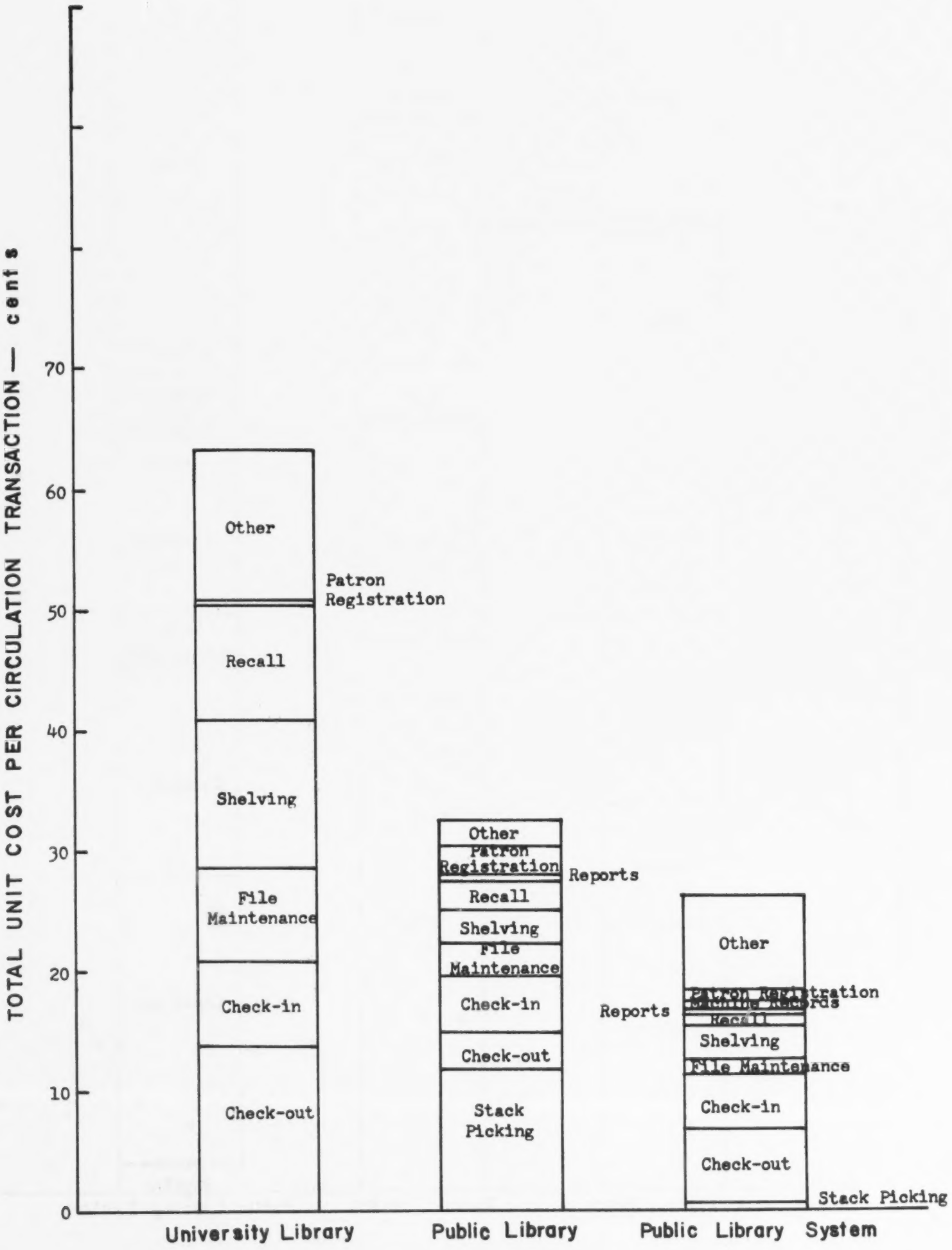

Fig. 5

Relative Size of Subsystem Unit Costs as Determined in the Three Case Studies

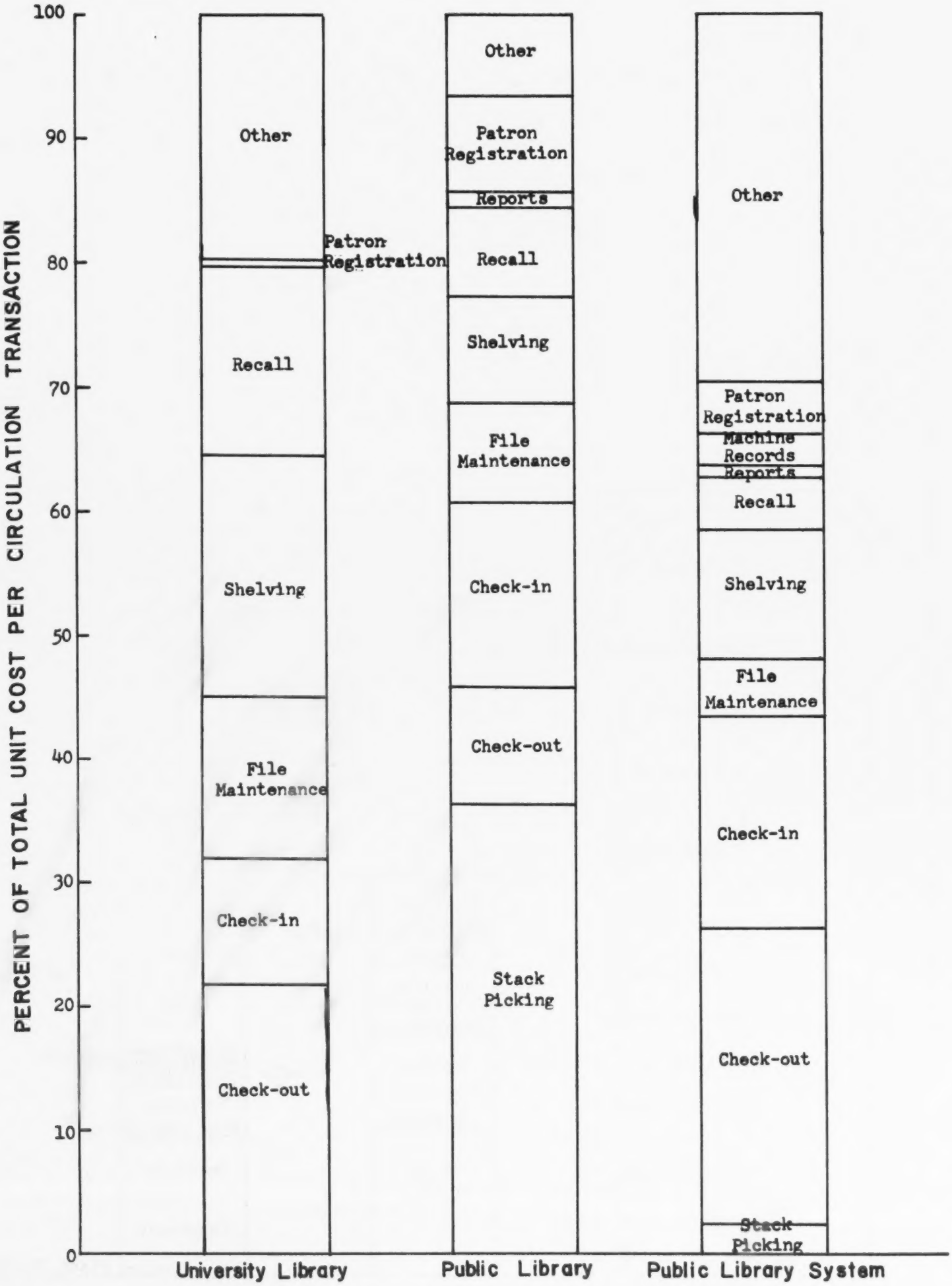

Fig. 6

Relative Percentage of Subsystem Unit Costs as Determined in the Three Case Studies

40-41

Appendix A

CIRCULATION SYSTEMS -- GENERAL COST MODEL AND REPORTING FORM

Organization and installation being analyzed: _____

_____

Type of library:

___ university or college
___ public
___ industrial
___ federal facility
___ other (specify) _____

Annual circulation volume of system being analyzed: _____

Reporter: _____

Dates of test data used for this report: _____

Date of report: _____

Literature references which describe this installation: _____

_____

1. STACK PICKING

(Refer to the report for description of scope of subsystem activities and types of costs to be included.)

A. Open-stack vs. closed stack operation (check appropriate entries)

___ All or almost all of the materials are picked up by the patron, who brings them to a checkout station; a negligible amount of file picking is done by the library staff.

___ Almost all of the materials are picked up by the library staff from the stack in response to requests, and delivered to a checkout station.

___ Both the staff and patrons pick up significant amounts of material from the shelves

B. Size of collection from which the file picking is being done: _____ volumes.

C. Labor used for staff file picking:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$

D. Other costs incurred in file picking:

Item or Service	Total Cost During This Reporting Period ($)
Total:	$

E. Total cost allocated to file picking during this reporting period:

Labor $_____

Other _____

Total $_____

F. Number of items picked from the stack by the library staff during this reporting period: _____

G. Total number of items checked out during this reporting period: _____

H. Unit picking cost (E ÷ F): $_____ per item picked.

I. Pro-rated unit file picking cost (E ÷ G): $_____ per circulation transaction.

2. CHECK-OUT TRANSACTION

A. Type of charge-out system used (mark appropriate entry):

___ manual
___ edge-notched card
___ photocharging
___ terminal equipment for reproduction of machine readable record (e.g., IBM card), at check-out station or remotely, onto another machine readable record (e.g., IBM card, paper tape, magnetic tape)
___ embossed plate printing system
___ heat-sensitive recording paper
___ on-line computer input
___ IBM punched card system
___ other (specify): _____

B. Extent of patron effort for check-out (mark appropriate entry):

___ patron fills out request card
___ patron only furnishes ID card
___ other (specify): _____

C. Labor used for check-out:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$

D. Equipment used for check-out:

Equipment Type and Model	Number of Units Used	Monthly Rental Cost or Equivalent ($)	Total Cost During This Reporting Period ($)
		Total:	$

E. Materials and supplies used for check-out:

Materials	Basic Costs of These Materials	Total Cost During This Reporting Period ($)
Charge cards		
IBM cards		
Edge-notched cards		
Microfilm		
Heat-sensitive paper		
	Total:	$

F. Other costs to be charged to the check-out process:

Item or Service	Total Cost During This Reporting Period ($)
Total:	$

G. Total cost allocated to the check-out process during this reporting period:

Labor $_____

Equipment _____

Material and supplies _____

Other _____

Total $_____

H. Total number of items checked out during this reporting period: _____

I. Unit cost of check-out process (G ÷ H): $_____ per circulation transaction.

3. CHECK-IN TRANSACTION

A. Labor used for check-in:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$

B. Equipment used for check-in (specify only if different from that used for check-out, or if the cost is to be divided between subsystems):

Equipment Type and Model	Number of Units Used	Monthly Rental Cost or Equivalent ($)	Total Cost During This Reporting Period ($)
		Total:	$

C. Materials and supplies used for check-in:

Materials Used	Basic Costs of These Materials	Total Cost During This Reporting Period ($)
IBM cards		
	Total:	$

D. Other costs to be charged to the check-in process:

Item or Service	Total Cost During This Reporting Period ($)
Total:	$

E. Total cost allocated to the check-in process during this reporting period:

Labor	$_____
Equipment	_____
Materials and supplies	_____
Other	_____
Total	$_____

F. Total number of items checked out during this reporting period: _____

G. Pro-rated unit cost of check-in process (E ÷ F): $_____ per circulation transaction.

4. FILE MAINTENANCE

A. Labor used for file maintenance:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$_____

B. Equipment used for file maintenance:

Equipment Type and Model	Number of Units Used	Monthly Rental Cost or Equivalent ($)	Total Cost During This Reporting Period ($)
		Total:	$_____

C. Materials and supplies used for file maintenance:

Materials Used	Basic Cost of These Materials	Total Cost During This Reporting Period ($)
	Total:	$

D. Other costs to be allocated to file maintenance:

Item or Service	Total Cost During This Reporting Period ($)
Total:	$

E. Total cost allocated to file maintenance during this reporting period:

Labor $_____

Equipment _____

Materials and supplies _____

Other _____

Total $_____

F. Total number of items checked out during this reporting period: _____

G. Pro-rated unit cost of file maintenance process (E ÷ F): $_____ per circulation transaction.

5. SHELVING

A. Labor used for returning the materials to their original locations:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$

B. Other costs of shelving:

Item or Service	Total Cost During This Reporting Period ($)
Total:	$

C. Total cost allocated to shelving during this reporting period:

Labor $_____

Other _____

Total $_____

D. Total number of items shelved during this reporting period: _____

E. Total number of items checked out during this reporting period: _____

F. Unit cost of shelving (C ÷ D): $_____ per item shelved.

G. Pro-rated unit cost of shelving (C ÷ E): $_____ per circulation transaction.

6. PREPARATION AND FOLLOWUP OF RECALL NOTICES AND BILLS

A. Labor used for preparation of notices, and recall followup:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$

B. Other costs to be allocated to preparation of notices, and recall followup:

Item or Service	Total Cost During This Reporting Period ($)
Postage	
Printed forms	
Total:	$

C. Total cost allocated to preparation of notices, and recall followup:

Labor $_____

Other _____

Total $_____

D. Total number of notices prepared during this reporting period:

First notice	_____
Second notice	_____
Third notice	_____
Bill	_____
Other	_____
Total	_____

E. Average number of notices prepared for each 1,000 circulation transactions (D) ÷ E (in thousands): _____

F. Total number of items checked out during this reporting period: _____

G. Unit cost of notice preparation and followup (C ÷ D): $_____ per notice prepared.

H. Pro-rated unit cost of notice preparation and followup (C ÷ F): $_____ per circulation transaction.

7. PREPARATION OF REPORTS

A. Types of reports prepared (other than recall or overdue notices, or bills, or simple circulation statistics reports): _____

_____

B. Labor used for preparation of reports:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$

C. Other costs to be allocated to the preparation of reports:

Item or Service	Basic Cost	Total Cost During This Reporting Period ($)
Total:		$_____

D. Total cost allocated to report preparation during this reporting period:

Labor $_____

Other _____

Total $_____

E. Total number of items checked out during this reporting period: _____

F. Pro-rated unit cost of preparation of reports (D ÷ E): $_____ per circulation transaction.

8. PREPARATION OF REPLACEMENT MACHINE BIBLIOGRAPHIC RECORDS

A. Labor used for preparation of machine bibliographic records:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$_____

B. Equipment used for the preparation of machine bibliographic records:

Equipment Type and Model	Number of Units Used	Monthly Rental Cost or Equivalent ($)	Total Cost During This Reporting Period ($)
		Total:	$

C. Materials and supplies used for preparation of machine bibliographic records:

Materials Used	Basic Costs of These Materials	Total Cost During This Reporting Period ($)
	Total:	$

D. Other costs to be allocated to preparation of machine bibliographic records:

Item or Service	Total Cost During This Reporting Period ($)
Total:	$

E. Total cost allocated to preparation of replacement machine bibliographic records during this reporting period:

Labor	$_____
Equipment	_____
Materials and supplies	_____
Other	_____
Total	$_____

F. Total number of machine bibliographic records prepared during this period: _____.

G. Total number of items checked out during this reporting period: _____.

H. Unit cost of preparation of machine bibliographic record (E ÷ F): $_____ per record.

I. Pro-rated unit cost of machine record preparation (E ÷ G): $_____ per circulation transaction.

9. PATRON REGISTRATION AND PREPARATION OF PATRON CARDS

A. Type of card prepared for each patron:

Type of Card	Frequency of Issue to Each Patron
Paper	_____
Paper with metal tag	_____
Embossed plastic (credit card type)	_____
IBM-punched plastic	_____
_____	_____
_____	_____

B. Total number of patron cards prepared during this reporting period: _____

C. Labor used for patron registration and preparation of patron cards:

Labor Type	Total No. Hrs. During This Reporting Period	Labor Rate ($/hr.)	Total Cost During This Reporting Period ($)
Total:			$

D. Equipment cost for patron registration and preparation of patron cards:

Equipment Type and Model	Number of Units Used	Monthly Rental Cost or Equivalent ($)	Total Cost During This Reporting Period ($)
		Total:	$

E. Materials and supplies for patron registration and preparation of patron cards:

Materials Used	Basic Costs of These Materials	Total Cost During This Reporting Period ($)
	Total:	$

F. Other costs allocated to patron registration and the preparation of patron cards:

Item or Service	Total Cost During This Reporting Period ($)
Total:	$

G. Total cost allocated to patron registration and preparation of patron cards:

Labor	$
Equipment	
Materials and supplies	
Other	
Total	$

H. Total number of items checked out during this reporting period: _____

I. Unit cost (G ÷ B): $_____ per card issued.

J. Pro-rated unit cost (G ÷ H): $_____ per circulation transaction.

10. OTHER COSTS

A. Item or Service	Total Cost During This Reporting Period ($)
Direct supervision labor not otherwise allocated	
Employee training time	

A. (cont.) Item or Service	Total Cost During This Reporting Period ($)
Total:	$

B. Total number of items checked out during this reporting period: _____

C. Pro-rated unit cost (A ÷ B): $_____ per circulation transaction.

11. TOTAL UNIT COST

	Cost per Circulation Transaction	Percent of Total Unit Cost
File picking (1 - I)	$_____	_____
Check-out transaction (2 - I)	_____	_____
Check-in transaction (3 - G)	_____	_____
File maintenance (4 - G)	_____	_____
Shelving (5 - G)	_____	_____
Preparation of recall notices and bills; and recall followup (6 - H)	_____	_____
Preparation of reports (7 - F)	_____	_____
Preparation of machine bibliographic records (8 - I)	_____	_____
Patron registration and preparation of patron cards (9 - J)	_____	_____
Other (10 - C)	_____	_____
Total	$_____	_____

Appendix B

INDEX TO INSTALLATIONS AND TYPES OF CIRCULATION SYSTEMS
REPORTED IN THE LITERATURE

Organization	Manual	Edge-Notched	Token	Photo-charging	Audio-charging	IBM Card Processing	Computer Processing	Reference
AERE Harwell							X	301
Arizona State University							X	21,82
Aroostook Teachers College	X							120
Atomic Energy of Canada							X	6
Atomic Energy Research Establishment, Harwell							X	106
Atomic Weapons Research Establishment							X	25,106,301
Auburn Community College							X	144
Bell Telephone Laboratories							X	4,174
Bowling Green State University							X	159
Bradley Polytechnic Inst. Lab.	X							31
Brighton Public Libraries							X	19
British Columbia Institute of Technology							X	6
Brock University							X	6
Brooklyn College						X		38,297
Catholic University							X	62
Charlotte Publishing					X			27
Chichester Library							X	32
College of Steubenville				X				60
Claremont University							X	62
Columbia College							X	300
Columbia University							X	102
Columbus Public Library						X	X	12,119
Community College of Philadelphia							X	199
Cooperative Book Centre of Canada, Ltd.							X	6
Decatur Public Library						X		148-9,152, 296

Organization	Manual	Edge-Notched	Token	Photo-charging	Audio-charging	IBM Card Processing	Computer Processing	Reference
Dept. of Agriculture, Ottawa							X	6
Detroit Public Library	X					X		217,231,303
District of Columbia Public Library	X			X				279
Eastern Michigan University						X		172
Epsom & Ewell District of Surrey County Library			X					96
Essendon Public Library, Australia							X	55
Florida Atlantic University							X	57,97,140-1
Gary Public Library				X				262,289
Georgetown University							X	199
Glendale Public Library	X			X				216
B. F. Goodrich Research Center							X	69
Harvard University		X				X	X	62,93,175,224
Holborn, England						X		90
IBM Advanced Systems Development and Research Library, San Jose						X		249
IBM Advanced Systems Development and Research Division							X	124,161
IBM Electronics Systems Center							X	273-4
IBM Research Library, Yorktown Heights						X		249
IBM, Thomas J. Watson Research Lab.							X	14,33-4,117
Illinois State Library				X			X	24,128-130,210
Indiana University		X					X	62,97,101,266
Indianapolis Public Library	X							265
Johns Hopkins Univ. Applied Physics Lab.							X	41
Johns Hopkins University							X	80-1,253
Lehigh University							X	97,103-105
Lindsey Hopkins Vocational School						X		22

Organization	Manual	Edge-Notched	Token	Photo-charging	Audio-charging	IBM Card Processing	Computer Processing	Reference
Lockheed Missiles & Space Co.						X		222
London Public Library, England				X				282
Los Angeles Public Library							X	9
Manitoba Inst. of Technology							X	6
McMaster University							X	6
Michigan State University							X	62,70-1
Midwestern University							X	49,50,162
Mill Valley Public Library						X		303
Milwaukee Public Library						X		26
Minneapolis Public Library				X				210
Mississippi State University							X	67
Montclair Public Library						X		2,33-4,59,246-7
NASA Manned Spacecraft Center							X	52
National Reactor Testing Station						X	X	121,276-7
National Science Library, Ottawa							X	6
New Bedford Library							X	139
Newark Public Library	X							231
Northwestern University							X	10
Norwich Central Lending Library, England					X			143
Oakland University							X	23,65
Oak Ridge National Laboratory	X						X	126
Orange County Public Library							X	185
Pennsylvania State College		X						272
Picatinny Arsenal							X	138
Prince George's County Memorial Library							X	127

Organization	Manual	Edge-Notched	Token	Photo-charging	Audio-charging	IBM Card Processing	Computer Processing	Reference
Queen's University of Belfast, England							X	48,106,177-82
Redstone Scientific Information Center							X	13
Rice University						X	X	97,153,255-6
Rio Hondo Junior College							X	44
Sandia Corp.						X	X	91,232,249
Simon Fraser University							X	6,209
Southampton University							X	106,178,301-2
Southern Illinois University		X					X	1,94,213
State University of Binghampton (N.Y.)							X	5
State University of New York, Buffalo							X	189-90
State University of New York, Upstate Medical Center							X	239-40
Stockton & San Joaquin County Public Library						X		184
Texas A & M University							X	97,269-70
Toronto Public Libraries		X						47
Torquay Public Library						X		237
Tulsa Public Library		X						207
University of Adelaide							X	20
University of Alberta							X	6
University of Bochum, West Germany							X	106,235
University of British Columbia							X	6,135
University of Calgary							X	6
University of California, Los Angeles	X					X		39,84-86
University of Chicago							X	109-11
University of Dayton							X	199
University of Florida						X		100,243

Organization	Manual	Edge-Notched	Token	Photo-charging	Audio-charging	IBM Card Processing	Computer Processing	Reference
University of Georgia						X		272
University of Guelph							X	6
University of Hawaii							X	62,64,264
University of Illinois							X	140
University of Kansas							X	62
University of Kent, Canterbury	X						X	17,106
University of Laval							X	6
University of Manitoba							X	6
University of Maryland						X		83,131-2
University of Michigan							X	3,62
University of Missouri		X				X	X	57,225,230
University of New Mexico							X	233
University of Oklahoma							X	62
University of Pittsburgh							X	62
University of Rochester							X	62
University of Saskatchewan							X	37
University of Southampton							X	215
University of Texas						X		225
University of Toronto							X	6
University of Victoria							X	6,66
University of Waterloo							X	6
University of Western Australia							X	11
University of Windsor							X	6,170-71
Vancouver Public Library		X						251
Ventura County & City Library						X		291
Walthamston Public Library, England						X		194
Wandsworth Public Library, England		X						77-79
Washington University							X	257
Washington University, School of Medicine						X	X	45,97,218-19,239

Organization	Manual	Edge-Notched	Token	Photo-charging	Audio-charging	IBM Card Processing	Computer Processing	Reference
West Sussex County Library, Chichester							X	106,301
West Sussex, England				X		X		89
Wisconsin State College		X						145
Women's College of University of North Carolina	X							147
Yale Medical Library		X						176
Yale University							X	62
Youngstown & Mahoning County Public Library				X				43

Appendix C

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15. ABSTRACT *(250 words max.)*

A literature review was made to find publications that reported cost data for library circulation systems. Such cost data from the reports of over 20 organizations was analyzed and summarized. Most of these reports gave total unit cost data ranging from 5 to 15 cents per circulation loan transaction, although much of this reporting could be characterized as incomplete and inaccurate.

A general cost model and cost reporting procedure for library circulation systems was developed and tested on the circulation systems of three representative libraries. These libraries included a large university library and two large public libraries. This model breaks the circulation system into several subsystems (e.g., check-out, check-in, shelving, and others) and permits the computation of unit costs for each of these component subsystems.

Cost data developed from these three case studies, using the new cost model and reporting procedure, is summarized and reviewed in this report. The cost reporting form is included in this report in such a way that it can readily and easily be used by interested libraries for the analysis of their own circulation system costs, and for a comparison of their costs with the case study costs given in this report.

16. RETRIEVAL TERMS *(Continue on reverse)*

cost analysis
libraries
circulation systems
cost models
evaluation
library automation

17. IDENTIFIERS